



TFT LCD Approval Specification

MODEL NO.: M220Z1-P03

Customer : _____

Approved by : _____

Note :

記錄	工作	審核	角色	投票
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- CONTENTS -

REVISION HISTORY	3
1. GENERAL DESCRIPTION	4
1.1 OVERVIEW	
1.2 FEATURES	
1.3 APPLICATION	
1.4 GENERAL SPECIFICATIONS	
1.5 MECHANICAL SPECIFICATIONS	
2. ABSOLUTE MAXIMUM RATINGS	5
2.1 ABSOLUTE RATINGS OF ENVIRONMENT (BASED ON CMO MODULE M220Z1-L03)	
2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)	
2.3 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)	
3. ELECTRICAL CHARACTERISTICS	7
3.1 TFT LCD OPEN CELL	
4. BLOCK DIAGRAM	9
4.1 TFT LCD OPEN CELL	
5. INPUT TERMINAL PIN ASSIGNMENT	10
5.1 TFT LCD MODULE	
5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL	
5.3 COLOR DATA INPUT ASSIGNMENT	
6. INTERFACE TIMING	13
6.1 INPUT SIGNAL TIMING SPECIFICATIONS	
6.2 POWER ON/OFF SEQUENCE	
7. OPTICAL CHARACTERISTICS	15
7.1 TEST CONDITIONS	
7.2 OPTICAL SPECIFICATIONS	
7.3 FLICKER ADJUSTMENT	
8. PACKAGING	20
8.1 PACKING SPECIFICATIONS	
8.2 PACKING METHOD	
9. DEFINITION OF LABELS	22
9.1 OPEN CELL LABEL	
9.2 CARTON LABEL	
10. PRECAUTIONS	23
10.1 ASSEMBLY AND HANDLING PRECAUTIONS	
10.2 SAFETY PRECAUTIONS	
11. MECHANICAL DRAWING	24

**REVISION HISTORY**

Version	Date	Section	Description
Ver. 2.0	April, 10 '07	-	M220Z1-P03 Approval Specifications was first issued.



1. GENERAL DESCRIPTION

1.1 OVERVIEW

The M220Z1-P03 is a 22-inch wide TFT LCD cell with driver ICs and a 30-pins-2ch-LVDS circuit board.
The product supports 1680 x 1050 WSXGA+ (16:10 wide screen) mode and can display up to 16.7M colors. The backlight unit is not built in.

1.2 FEATURES

- Super wide viewing angle
- High contrast ratio
- Fast response time
- High color saturation
- WSXGA+ (1680 x 1050 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- RoHS Compliance

1.3 APPLICATION

- TFT LCD Monitor
- TFT LCD TV
- Workstation & desktop monitor
- Display terminals for AV application

1.4 GENERAL SPECIFICATIONS

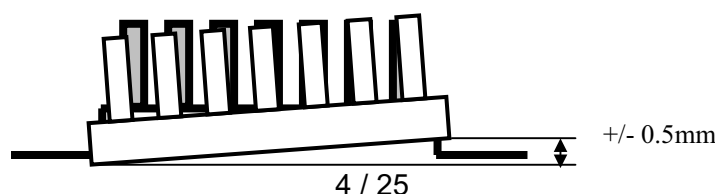
Item	Specification	Unit	Note
Diagonal Size	22.0	inch	
Active Area	473.76 (H) x 296.10 (V)	mm	(1)
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1680 x R.G.B. x 1050	pixel	-
Pixel Pitch	0.282 (H) x 0.282 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally White	-	-
Surface Treatment	Hard coating (3H), Anti-glare (Haze 25%)	-	-

1.5 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Weight	-	-	615	g	-
I/F connector mounting position	The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

(2) Connector mounting position





2. ABSOLUTE MAXIMUM RATINGS

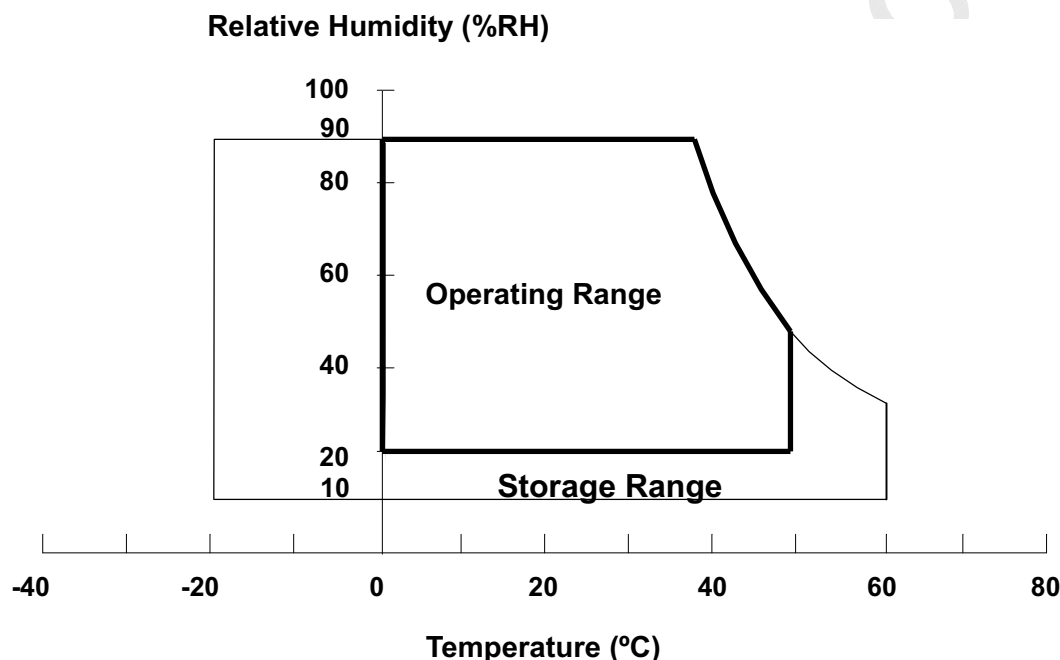
2.1 ABSOLUTE RATINGS OF ENVIRONMENT (BASED ON CMO MODULE M220Z1-L03)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)

Note (1) Temperature and relative humidity range is shown in the figure below.

- (a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).
- (b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40\text{ }^{\circ}\text{C}$).
- (c) No condensation.

Note (2) The temperature of panel display surface area should be 0 °C Min. and 60 °C Max.





2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

High temperature or humidity may reduce the performance of panel. Please store LCD panel within the specified storage conditions.

Storage Condition: With packing.

Storage temperature range: 25 ± 5 °C.

Storage humidity range: $50\pm10\%$ RH.

Shelf life: 30days

2.3 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)

Item	Symbol	Value		Unit	Note
		Min	Max		
Power Supply Voltage	V_{CC}	-0.3	+5.5	V	(1)
Logic Input Voltage	V_{IN}	-0.3	4.3	V	

Note (1) Permanent damage might occur if the module is operated at conditions exceeding the maximum values.

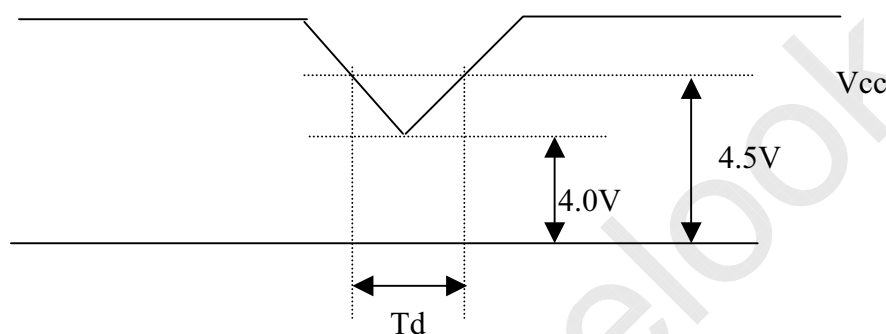
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

 $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	4.5	5.0	5.5	V	-
Ripple Voltage		V _{RP}	-	--	100	mV	-
Rush Current		I _{RUSH}	-	--	3	A	(2)
Power Supply Current	White	I _{CC}	-	630	819	mA	(3)a
	Black		-	1170	1521	mA	(3)b
	f _V = 75Hz, V _{CC} =4.5V		-	1330	1729	mA	(4)
LVDS differential input voltage		V _{id}	-100	-	+100	mV	
LVDS common input voltage		V _{ic}	--	1.2	--	V	

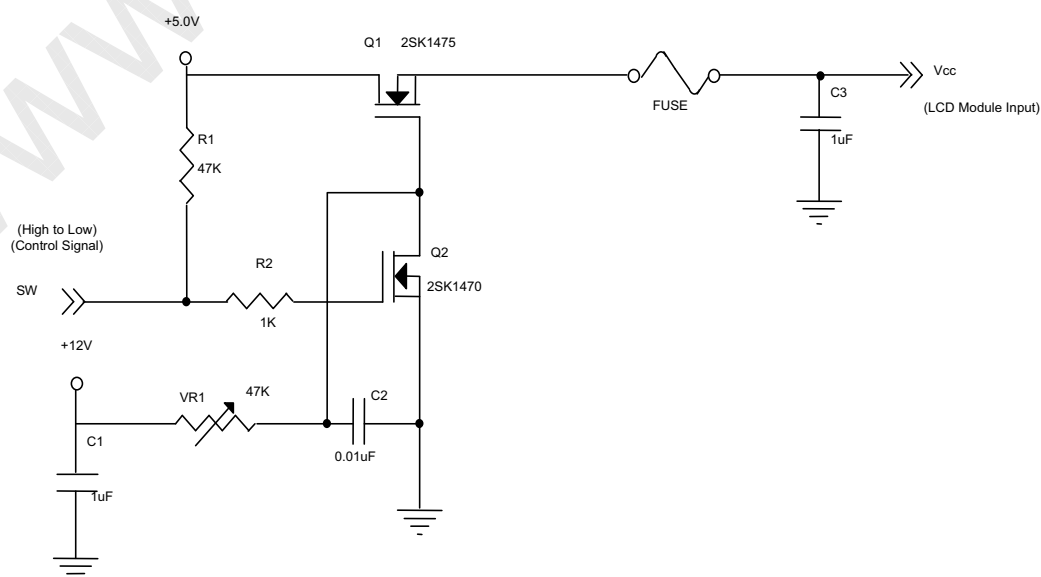
3.1.2 V_{CC} Power Dip Condition:



Dip condition: $4.0\text{V} \leq V_{CC} \leq 4.5\text{V}, T_d \leq 20\text{ms}$

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:



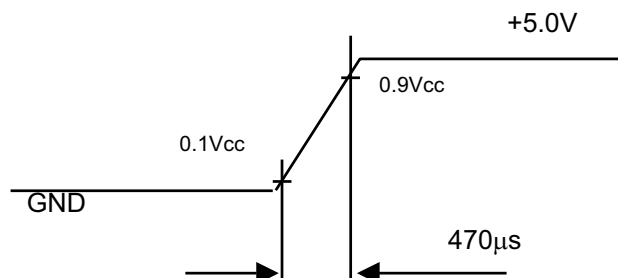


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Model No.: M220Z1-P03

Approval

Vcc rising time is 470 μ s



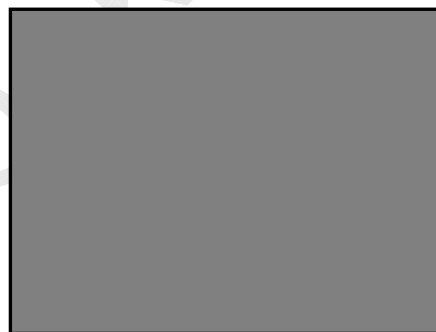
Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 $\pm$ 2 $^{\circ}$ C, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area

Note (4) The specified power supply current is under the conditions at Vcc = 4.5 V, Ta = 25 $\pm$ 2 $^{\circ}$ C, f_v = 75 Hz, whereas a power dissipation check pattern (Black Pattern) below is displayed.

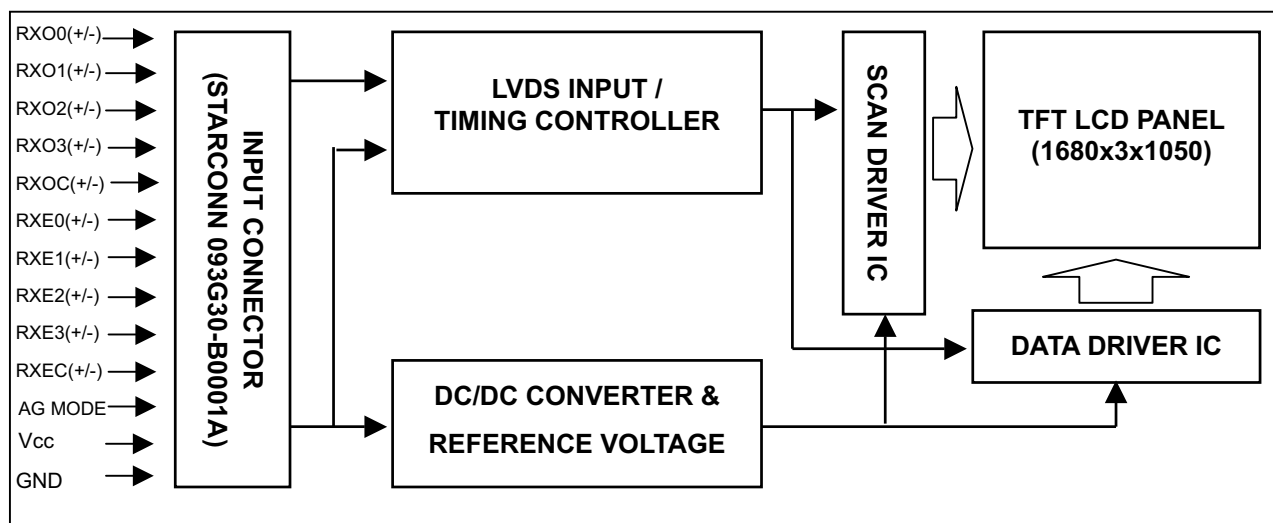
Black Pattern



Active Area

4. BLOCK DIAGRAM

4.1 TFT LCD OPEN CELL





5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Name	Description
1	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
2	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
3	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
4	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
5	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
6	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RXOC-	Negative LVDS differential clock input. (odd)
9	RXOC+	Positive LVDS differential clock input. (odd)
10	RXO3-	Negative LVDS differential data input. Channel O3(odd)
11	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)
23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	Not connection, should open.
26	VCOM	VCOM Control, should open.
27	AGMODE	AGMODE should be tied to ground or open.
28	VCC	+5.0V power supply
29	VCC	+5.0V power supply
30	VCC	+5.0V power supply

Note (1) Connector Part No.: 093G30-B0001A(STARCONN) or FI-XB30SSL-HF(JAE) or EQUIVALENT.

Note (2) Mating Connector Part No.:FI-X30H ; FI-X30C* ; FI-X30M* ; FI-X30HL(-T),FI-X30C*L(-T) [JAE]

Note (3) The first pixel is odd.

Note (4) Input signal of even and odd clock should be the same timing.



5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL

SELLVDS = Low or Open								
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6
LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
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	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

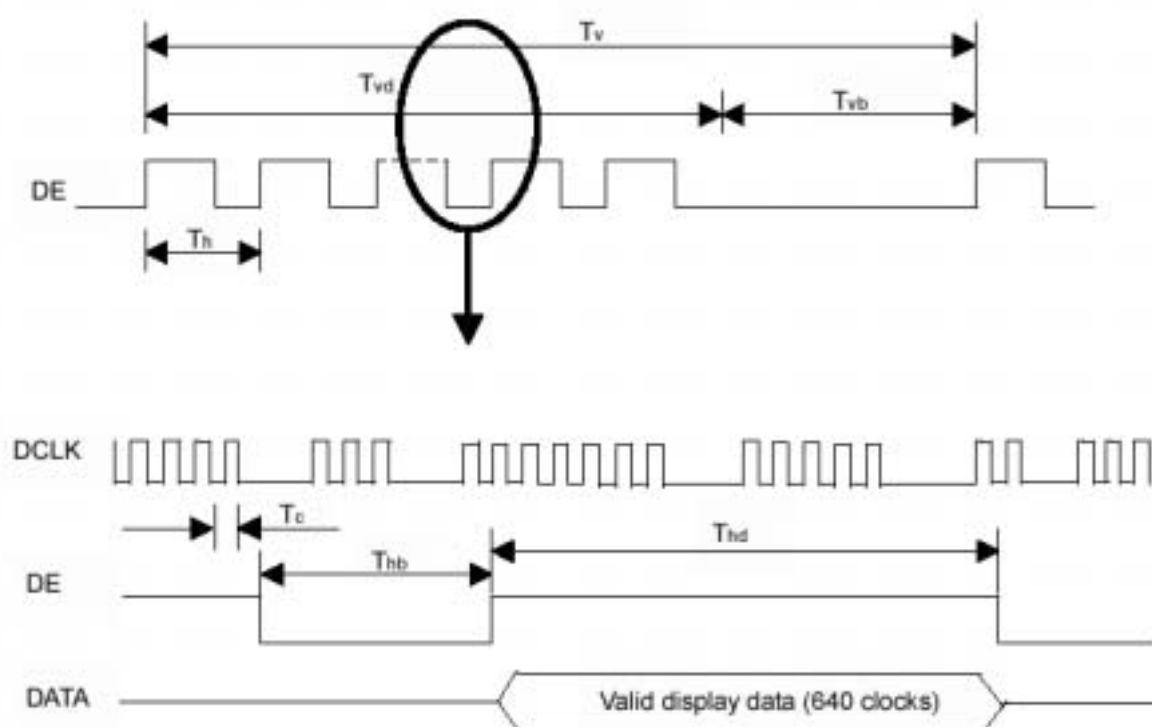
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	50	59.5	82	MHz	-
	Period	Tc	13.4	16.8	-	ns	-
	High Time	Tch	-	4/7	-	Tc	-
	Low Time	Tcl	-	3/7	-	Tc	-
LVDS Data	Setup Time	Tlvs	600	-	-	ps	-
	Hold Time	Tlvh	600	-	-	ps	-
Vertical Active Display Term	Frame Rate	Fr	50	60	76	Hz	Tv=Tvd+Tvb
	Total	Tv	1060	1080	1195	Th	-
	Display	Tvd	1050	1050	1050	Th	-
	Blank	Tvb	Tv-Tvd	30	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	890	920	1000	Tc	Th=Thd+Thb
	Display	Thd	840	840	840	Tc	-
	Blank	Thb	Th-Thd	80	Th-Thd	Tc	-

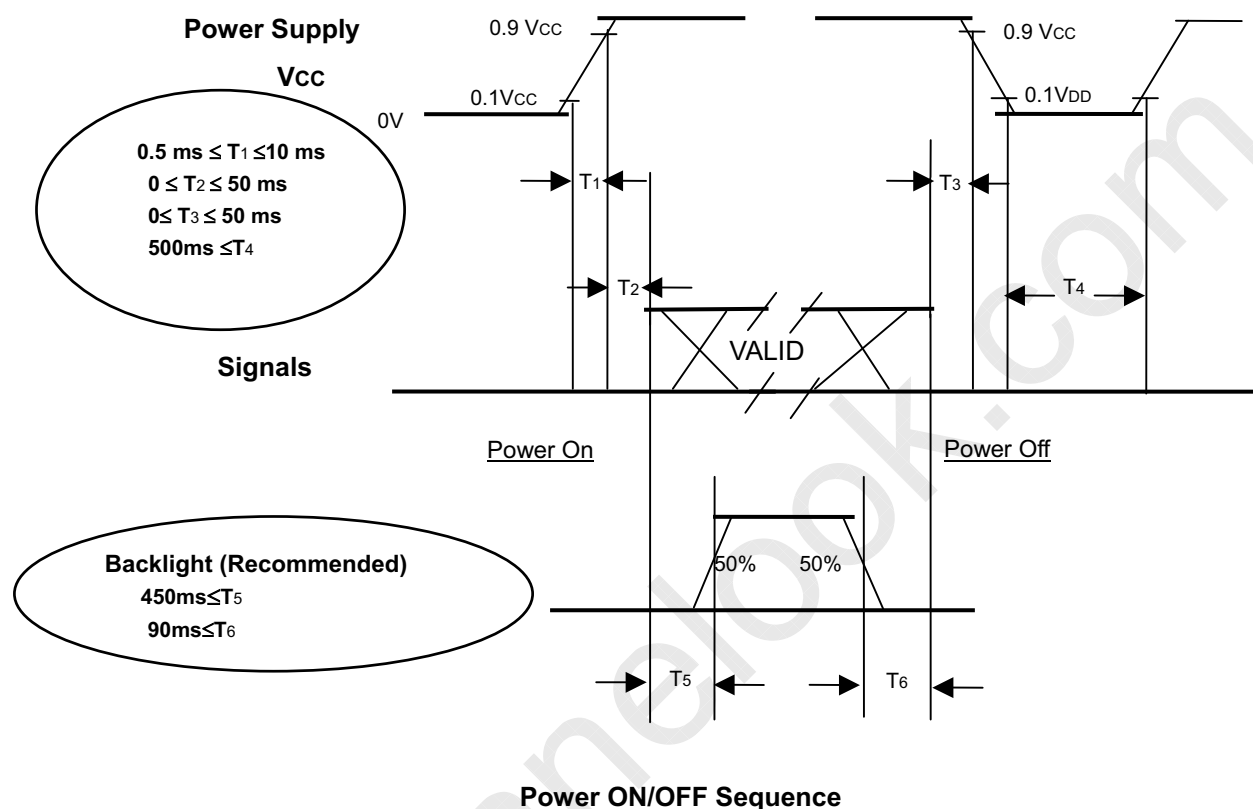
Note : (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



Note.

- (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.
- (2) Please apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation of the LCD turns off, the display may, instantly, function abnormally.
- (3) In case of Vcc = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T4 should be measured after the module has been fully discharged between power on/off periods.
- (5) Interface signal shall not be kept at high impedance when the power is on.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I _L	7.0	mA
Inverter Driving Frequency	F _L	61	KHz

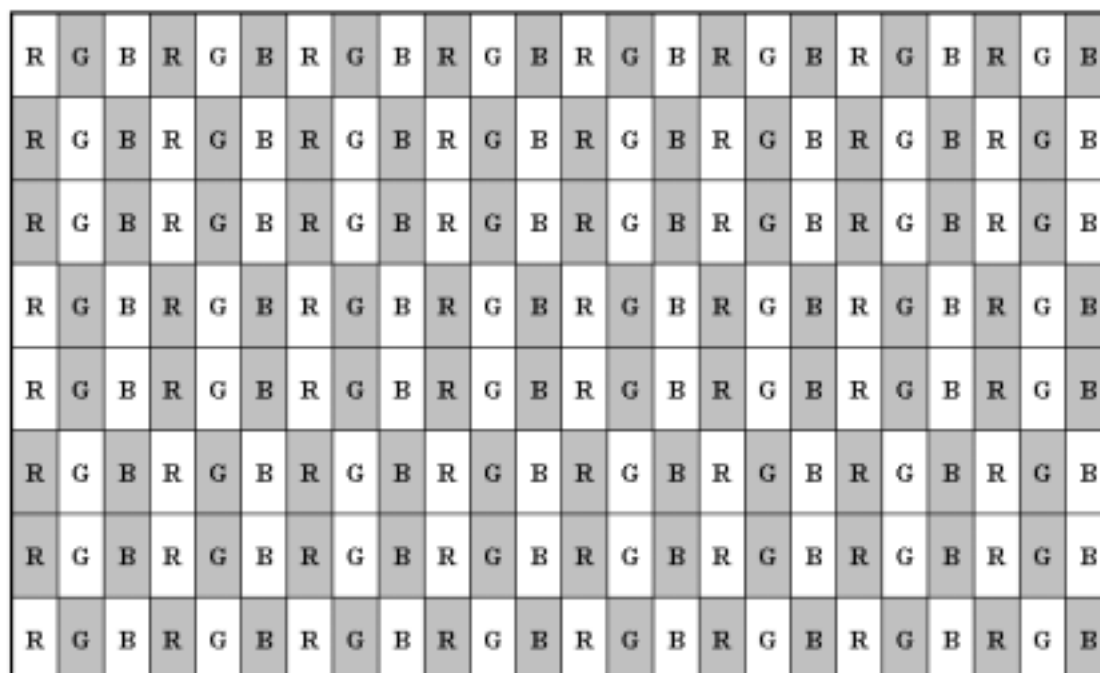
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown as below. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rcx	$\theta_x=0^\circ, \theta_Y=0^\circ$ CS-1000T Standard light source “C”	Typ - 0.03	0.650	Typ + 0.03	-	(0),(6)
		Rcy			0.330		-	
	Green	Gcx			0.285		-	
		Gcy			0.575		-	
	Blue	Bcx			0.145		-	
		Bcy			0.101		-	
	White	Wcx			0.320		-	
		Wcy			0.356		-	
Center Transmittance		T%	$\theta_x=0^\circ, \theta_Y=0^\circ$	5.2	5.8	---	%	(1), (8)
Contrast Ratio		CR	CS-1000T, CMO BLU	700	1000	---	-	(1), (3)
Response Time		T _R	$\theta_x=0^\circ, \theta_Y=0^\circ$	---	1.3	2.2	ms	(4)
		T _F		---	3.7	5.8	ms	
Transmittance uniformity		δT%	$\theta_x=0^\circ, \theta_Y=0^\circ$ USB2000	---			-	(1), (7)
Viewing Angle	Horizontal	θ _x +	CR≥10 USB2000	75	85	---	Deg.	(1), (2) (6)
		θ _x -		75	85	---		
	Vertical	θ _y +		70	80	---		
		θ _y -		70	80	---		

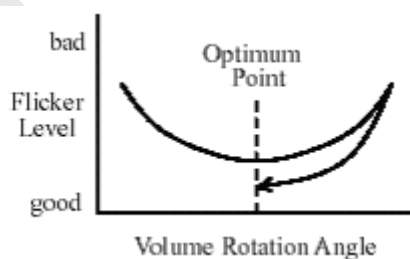
7.3 Flicker Adjustment

(1) Adjustment Pattern: 2H1V checker pattern as follows.



(2) Adjustment Method:

Flicker should be adjusted by turning the volume for flicker adjustment by the ceramic driver. It is adjusted to the point with least flickering of the whole screen. After making it surely overrun at once, it should be adjusted to the optimum point.

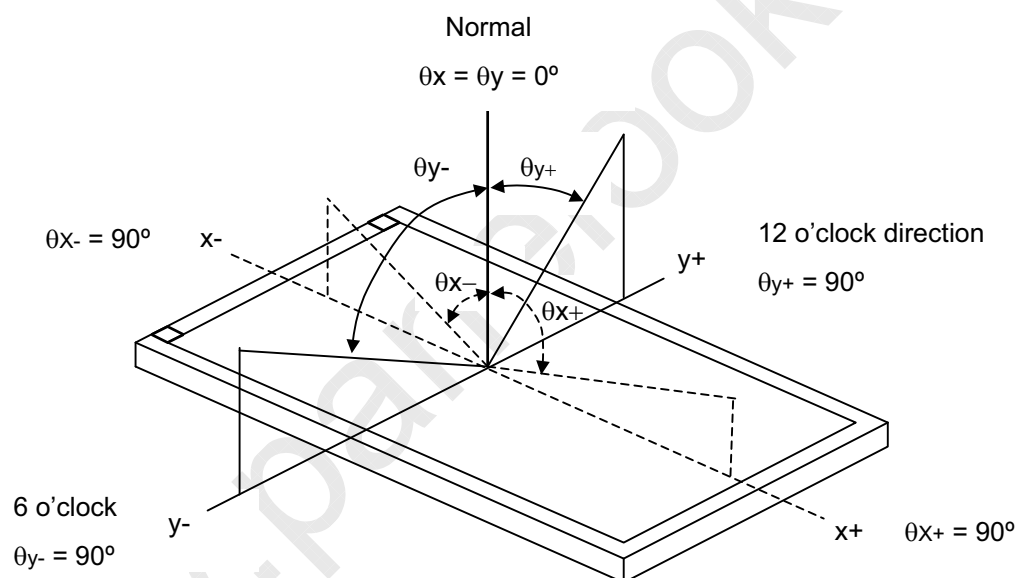


Note (0) Light source is the standard light source "C" which is defined by CIE and driving voltages are based on suitable gamma voltages. The calculating method is as following :

1. Measure Module's and BLU's spectrums. White is without signal input and R, G, B are with signal input. BLU(for M220Z1-L03) is supplied by CMO.
2. Calculate cell's spectrum.
3. Calculate cell's chromaticity by using the spectrum of standard light source "C"

Note (1) Light source is the BLU which is supplied by CMO and driving voltages are based on suitable gamma voltages.

Note (2) Definition of Viewing Angle (θ_x , θ_y):



Note (3) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

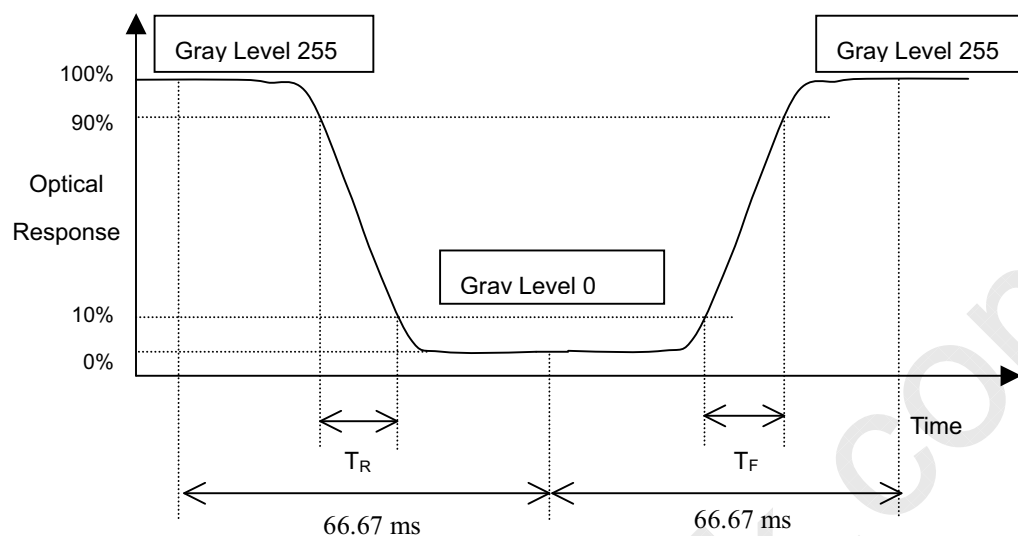
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (7).

Note (4) Definition of Response Time (T_R , T_F):



Note (5) Definition of Luminance of White (L_C):

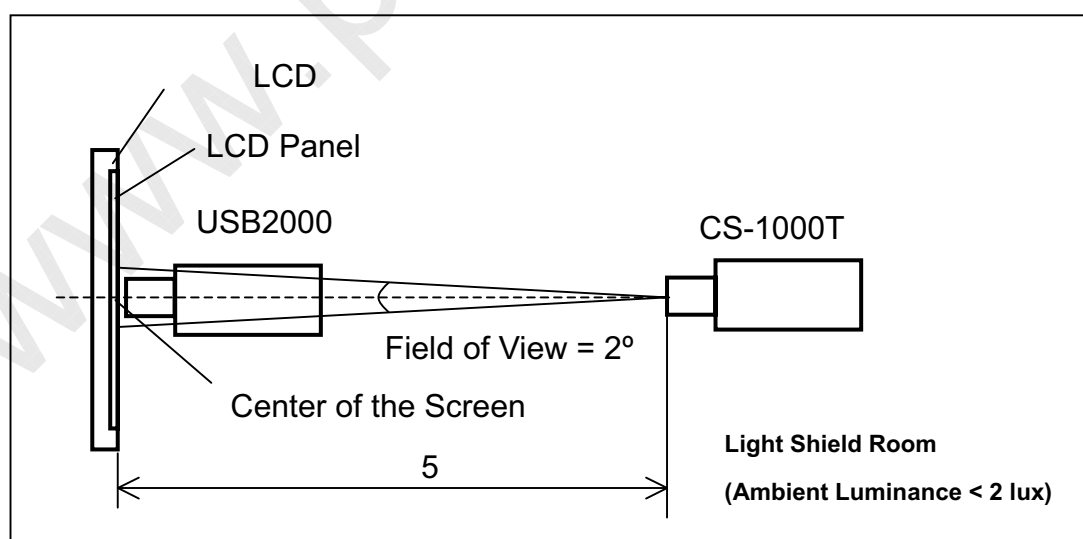
Measure the luminance of gray level 255 at center point

$$L_C = L(5)$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (7).

Note (6) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

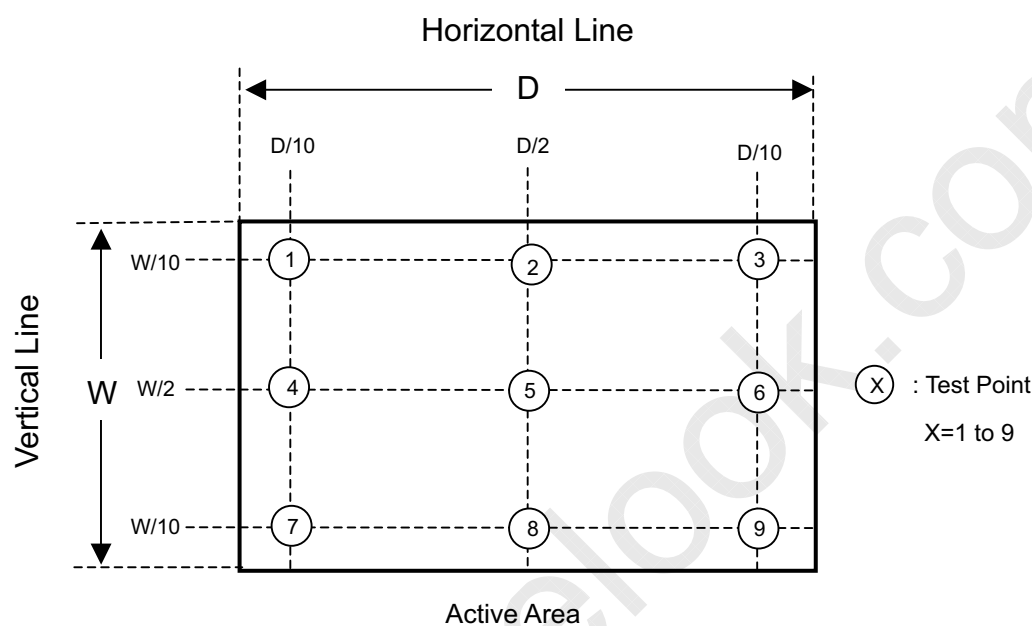




Note (7) Definition of Transmittance Variation ($\delta T\%$):

Measure the transmittance at 9 points

$$\delta T\% = \frac{\text{Maximum [L (1), L (2), \dots, L (12), L (9)]}}{\text{Minimum [L (1), L (2), \dots, L (12), L (9)]}}$$



Note (8) Definition of Transmittance ($T\%$):

Module is without signal input.

$$\text{Transmittance} = \frac{\text{Luminance of LCD module}}{\text{Luminance of backlight}} * 100\%$$



8. PACKAGING

8.1 PACKING SPECIFICATIONS

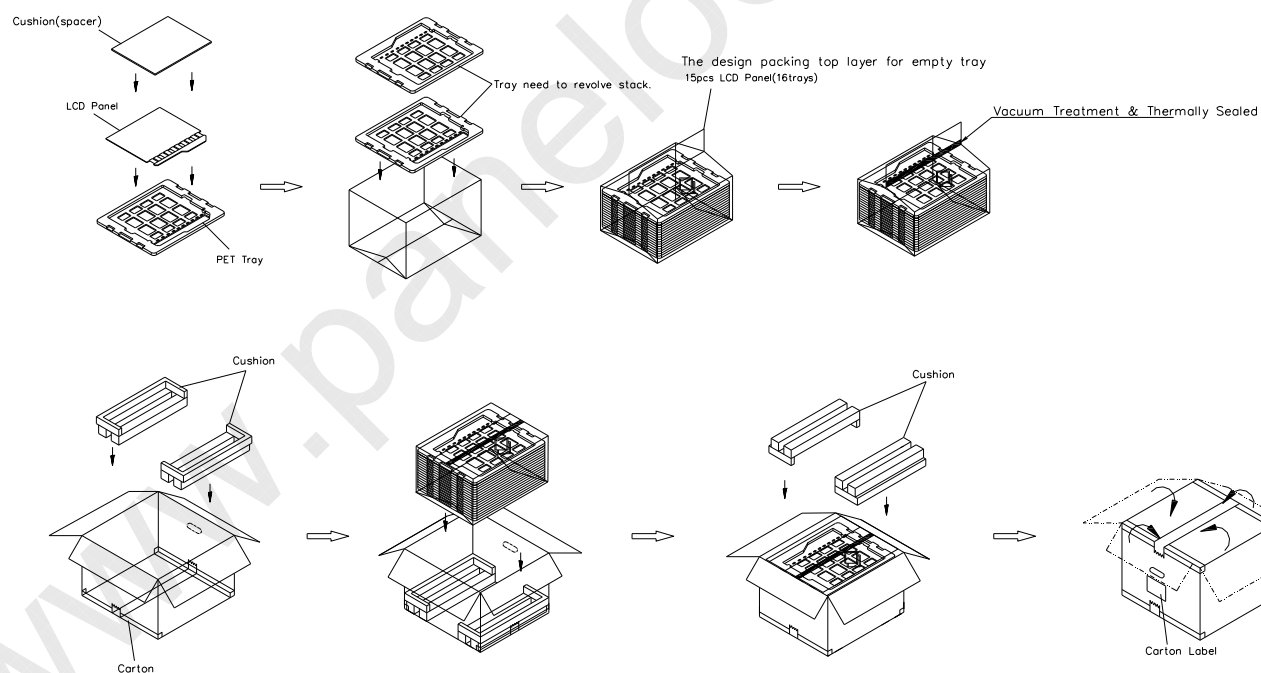
- (1) 15 open cells / 1 Box
- (2) Box dimensions: 650 (L) X 550 (W) X 385 (H) mm
- (3) Weight: approximately 17.6Kg (15 open cells per box)

8.2 PACKING METHOD

- (1) Carton Packing should have no failure in the following reliability test items

Test Item	Test Conditions	Note
Packing Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation

- (2) Packing method.



- (1) 15 LCD Cells+PCB/1 box
- (2) Carton dimensions : 650(L)x550(W)x385(H)mm
- (3) Weight : approximately 17.6kg(15 Cells per Carton).

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Doc. No.:

Issued Date: April. 10, 2007

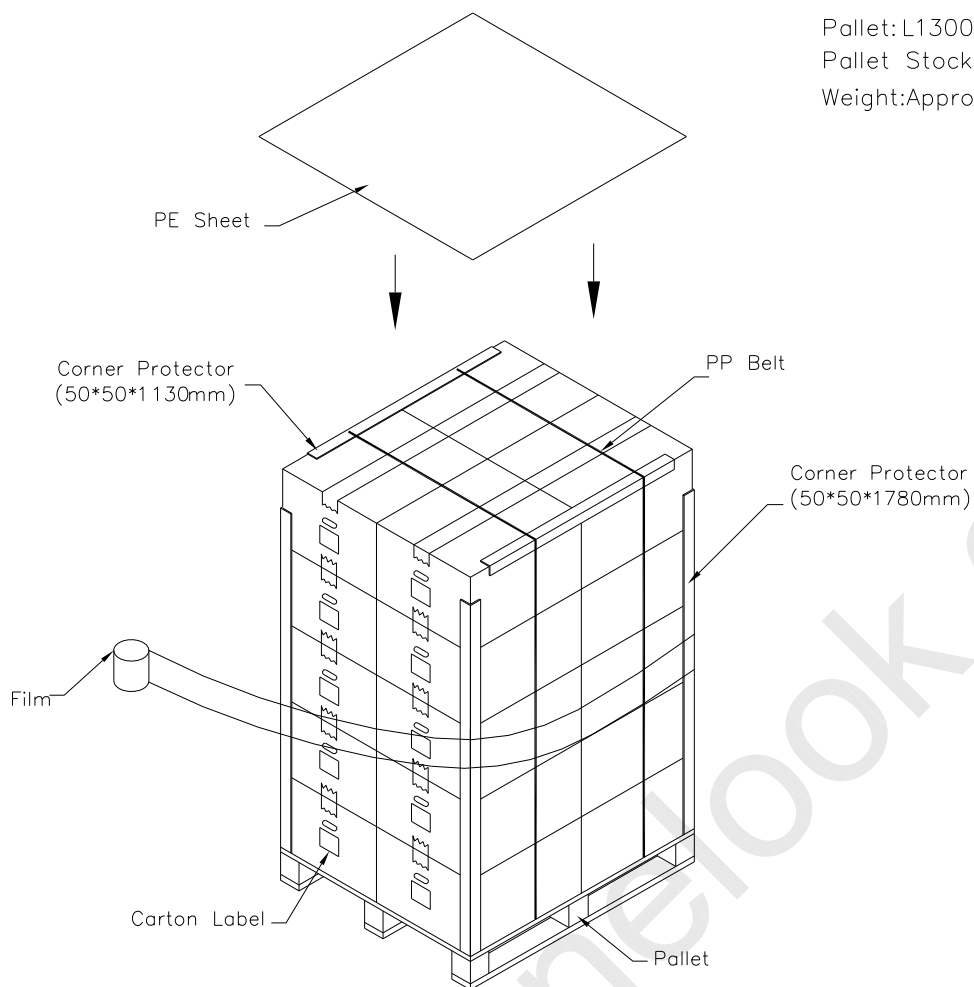
Model No.: M220Z1-P03

Approval

Pallet: L1300*W1140*H145mm

Pallet Stock Dim: L1300*W1140*H2070mm

Weight: Approx. 372kg



9. DEFINITION OF LABELS

9.1 CMO OPEN CELL LABEL

The barcode nameplate is pasted on each OPEN CELL as illustration for CMO internal control.



Barcode definition:

Serial ID: CM-22Z13-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	CMO=CM
22Z13	Model number	M220Z1-P03=22Z13
X	Revision code	Non ZBD: 0~9, ZBD: A~Z
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M
X	Gate driver IC code	
XX	Cell location	Tainan, Taiwan=TN
L	Cell line #	0~12=1~C
XX	Module location	Tainan, Taiwan=TN
L	Module line #	0~12=1~C
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31= 1, 2, 3, ~, 9, A, B, C, ~, T, U, V
NNNN	Serial number	Manufacturing sequence of product

9.2 CARTON LABEL

The barcode nameplate is pasted on each box as illustration, and its definitions are as following explanation



- (a) Model Name: M220Z1 -P03
- (b) Carton ID: CMO internal control
- (c) Quantities: 15 pcs

10. PRECAUTIONS

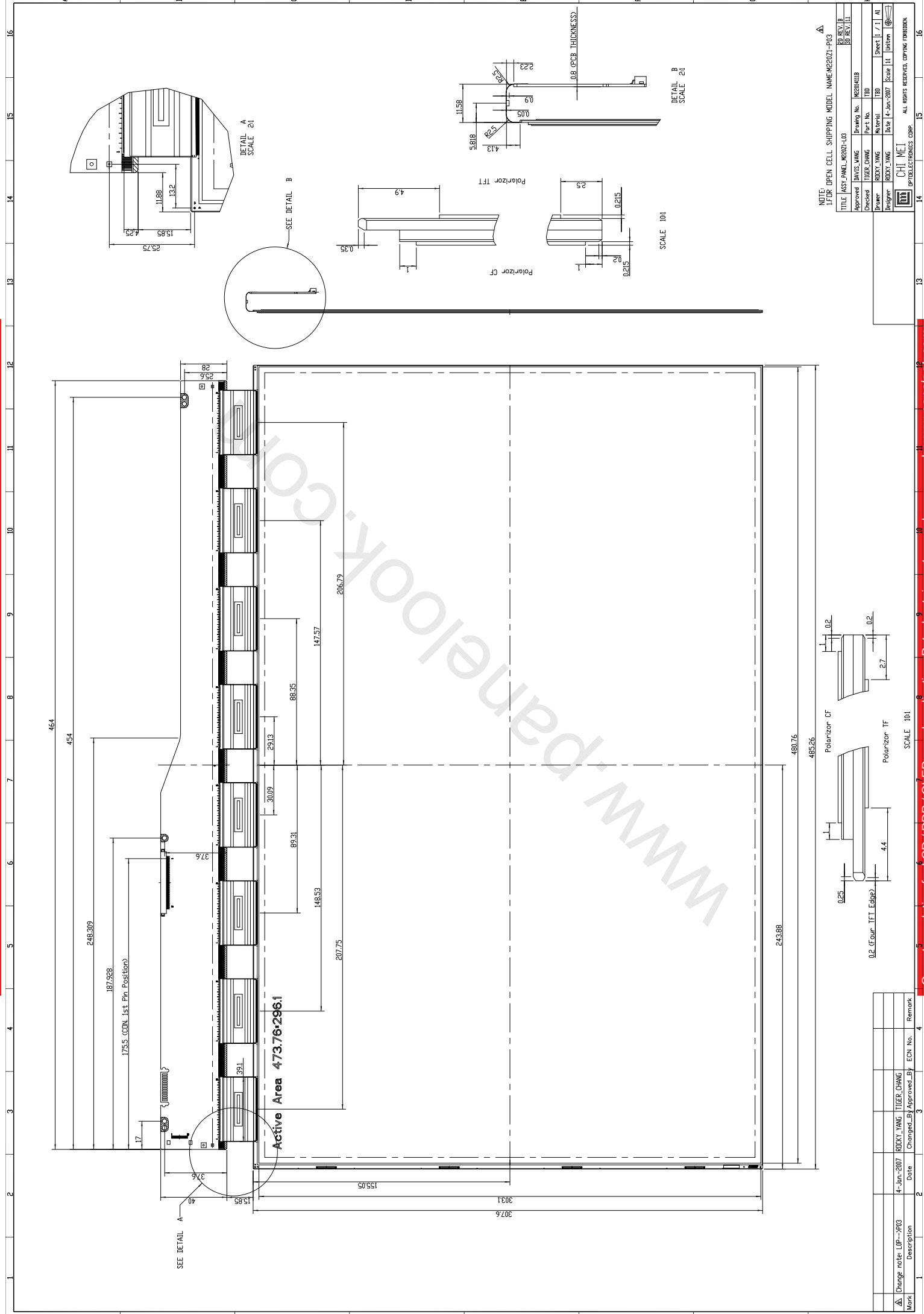
10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the product during assembly.
- (2) To assemble backlight or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It is not permitted to have pressure or impulse on the module because the LCD panel will be damaged.
- (4) Always follow the correct power sequence when the product is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (7) It is dangerous that moisture come into or contacted the product, because moisture may damage the product when it is operating.
- (8) High temperature or humidity may reduce the performance of module. Please store this product within the specified storage conditions.
- (9) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.

10.2 SAFETY PRECAUTIONS

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the product's end of life, it is not harmful in case of normal operation and storage.

11. MECHANICAL DRAWING



NOTE:
1.FOR OPEN CELL SHIPPING MODEL NAME:M2021-P03

TITLE	ASSY_PANEL_M2021-L03	REV. 1	REV. 1
Approved	DAVIS WANG	Drawing No.	M2021L118
Checked	TIGER CHANG	Part No.	TBD
Drawn	ROCKY YANG	Material	TBD
Designer	ROCKY YANG	Date	4-Jan-2007
Scale	1:1	Sheet	1 of 1

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Mark	Description	Date	Changed By	Approved By	ECN No.	Remark
Δ	Change note 1 (PDP)	4-Jan-2007	ROCKY YANG	TIGER CHANG		